CLAIMS

What is claimed is:

1. A coating system comprising:

a substrate having a first color effect; and

a film layer that is at least partially-transparent to visible light and is applied on said substrate for producing a second color effect different from said first color effect of said substrate wherein said film layer is the reaction product of a curable, powder-based coating composition comprising;

a powder-based binder comprising the reaction product of,

a resin having a functional group, and

a cross-linking agent reactive with said functional group of said resin, and

a color effect-providing pigment comprising;

a pigment substrate having first and second substantially parallel and planar surfaces, and

an inorganic coating disposed on at least one of said first and second substantially parallel and planar surfaces of said pigment substrate (B)(I), said inorganic coating (B)(II) having an index of refraction of 1.8 or less,

wherein said inorganic coating (B)(II) and said pigment substrate (B)(I) of said color effect-providing pigment (B) interact with said first color effect of said substrate to produce said second color effect upon application of the film layer of the powder-based coating composition to the substrate.

2. A coating system as set forth in claim 1 wherein said color-effect providing pigment further comprises a reflective, absorbing coating which is at least partially transparent to visible light.

3. A coating system as set forth in claim 2 wherein said reflective, absorbing coating comprises a selectively absorbing metal oxide.

4. A coating system as set forth in claim 2 wherein said reflective, absorbing coating comprises a non-selectively absorbing metal.

5. A coating system as set forth in claim 2 wherein said reflective, absorbing coating is disposed on said inorganic coating.

6. A coating system as set forth in claim 5 wherein said color effect-providing pigment further comprises an outer coating disposed on said reflective, absorbing coating.

7. A coating system as set forth in claim 6 wherein said outer coating is different from said reflective, absorbing coating and comprises a selectively absorbing metal oxide.

8. A coating system as set forth in claim 1 wherein said pigment substrate of said color effect-providing pigment is selected from the group consisting of metallic pigment substrates, non-metallic pigment substrates, and combinations thereof.

9. A coating system composition as set forth in claim 1 wherein said pigment substrate is selected from the group consisting of aluminum, chromium, nickel, stainless steel, and combinations thereof.

10. A coating system as set forth in claim 1 wherein said pigment substrate of said color effect-providing pigment has an average particle size of from 5 to 50 μm.

11. A coating system as set forth in claim 1 wherein said pigment substrate of said color effect-providing pigment is further defined as a platelet-shaped pigment substrate.

12. A coating system as set forth in claim 1 wherein said pigment substrate is steel.

13. A coating system as set forth in claim 12 wherein said steel pigment substrate is stainless steel.

14. A coating system as set forth in claim 12 wherein said steel pigment substrate is an alloy of steel having from 1 to 30 parts by weight of chromium based on 100 parts by weight of said alloy of steel.

15. A coating system as set forth in claim 1 wherein said color effect-providing pigment has a multilayer interference structure that is symmetrical.

16. A coating system as set forth in claim 1 wherein said inorganic coating of said color effect-providing pigment comprises a metal oxide.

17. A coating system as set forth in claim 1 wherein said inorganic coating of said color effect-providing pigment is selected from the group consisting of metal oxides, magnesium fluoride, and combinations thereof.

18. A coating system as set forth in claim 1 wherein said inorganic coating of said color effect-providing pigment is selected from the group consisting of silicon oxide, silicon oxide hydrate, aluminum oxide, aluminum oxide hydrate, titanium oxide, titanium oxide hydrate, zinc sulfide, magnesium fluoride, and combinations thereof.

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19. A coating system as set forth in claim 1 wherein said resin of said powder-based binder is selected from the group consisting of acrylic resins, epoxy resins, phenolic resins, polyester resins, urethane resins, and combinations thereof.

20. A coating system as set forth in claim 1 wherein said cross-linking agent of said powder-based binder is selected from the group consisting of aminoplasts, blocked isocyanates, polycarboxylic acids, acid anhydrides, polyamines, and combinations thereof.

21. A coating system as set forth in claim 1 wherein said inorganic coating and said pigment substrate of said color effect-providing pigment interact with said first color effect of the substrate such that said second color effect is different from said first color effect at least by ΔL 20.0, Δa 10.0, and Δb 15.0 as measured according to CIELab color space.

22. A coating system as set forth in claim 1 wherein said powder-based coating composition is a powder clearcoat applied on said substrate to produce said second color effect.

23. A coating system as set forth in claim 1 wherein said interaction of said inorganic coating and said pigment substrate with said first color effect of said substrate to produce said second color effect is further defined as interference of light waves that establishes angle-dependent color and lightness effects to achieve said second color effect.

24. A coating system as set forth in claim 1 wherein said interaction of said inorganic coating and said pigment substrate with said first color effect of said substrate to produce said second color effect is further defined as absorption of light waves that establishes angle-dependent color and lightness effects to achieve said second color effect.

25. A coating system as set forth in claim 1 wherein said interaction of said inorganic coating and said pigment substrate with said first color effect of said substrate to produce said second color effect is further defined as reflection of light waves that establishes angle-dependent color and lightness effects to achieve said second color effect.

26. A coating system as set forth in claim 1 comprising from 0.1 to 10 parts by weight of said color effect-providing pigment based on 100 parts by weight of said powder-based binder.

27. A coating system as set forth in claim 1 further comprising a second film layer applied on said film layer such that said coating system has a 20 degree gloss of at least 65, as defined by ASTM D523-89 (Re-Approved 1999).

28. A coating system as set forth in claim 1 wherein said substrate is further defined as an automotive body panel.

29. A coating system as set forth in claim 1 further comprising an underlying film layer applied to said substrate prior to application of said film layer.

30. A coating system as set forth in claim 29 wherein said underlying film layer is an electrocoat film layer.

31. A coating system as set forth in claim 29 wherein said underlying film layer is a primer surfacer film layer.

32. A coating system as set forth in claim 29 wherein said underlying film layer is a color-providing basecoat film layer.

33. A method for coating a substrate, having a first color effect, with a film layer that is at least partially transparent and that produces a second color effect different from the first color effect of the substrate, said method comprising the steps of:

(A) combining a powder-based binder and a color effect-providing pigment to establish a powder-based coating composition wherein;

the powder-based binder comprises the reaction product of;

a resin having a functional group, and

a cross-linking agent reactive with said functional group of said resin; and

the color effect-providing pigment comprises;

a pigment substrate having first and second substantially parallel and planar surfaces, and

an inorganic coating disposed on at least one of said first and second substantially parallel and planar surfaces of said pigment substrate (B)(I), said inorganic coating (B)(II) having an index of refraction of 1.8 or less; and

(B) applying the powder-based coating composition to the substrate to produce the second color effect as a result of an interaction of the inorganic coating and the pigment substrate of the color effect-providing pigment with the first color effect of the substrate.

34. A method as set forth in claim 33 wherein the step of (A) combining the powder-based binder and the color effect-providing pigment is further defined as

combining from 0.1 to 10 parts by weight of the color effect-providing pigment with the powder-based binder based on 100 parts by weight of the powder-based binder.

35. A method as set forth in claim 34 wherein the step of (A) combining the powder-based binder and the color effect-providing pigment is further defined as dry blending the color effect-providing pigment into the powder-based binder.

36. A method as set forth in claim 35 wherein the pigment substrate of the color effect-providing pigment has an average particle size of from 5 to 50 μm.

37. A method as set forth in claim 35 further comprising the step of agitating the dry blend of the color effect-providing pigment and the powder-based binder such that the color effect-providing pigment is uniformly dispersed throughout the powder-based binder.

38. A method as set forth in claim 33 wherein the step of (A) combining the powder-based binder and the color effect-providing pigment is further defined as extruding the color effect-providing pigment into the powder-based binder.

39. A method as set forth in claim 38 wherein the pigment substrate of the color effect-providing pigment is stainless steel.

40. A method as set forth in claim 38 further comprising the step of milling the extrusion of the color effect-providing pigment and the powder-based binder to establish the powder-based coating composition.

41. A method as set forth in claim 33 wherein the step of (A) combining the powder-based binder and the color effect-providing pigment is further defined as bonding the color effect-providing pigment with the powder-based binder.

42. A method as set forth in claim 41 wherein the step of bonding the color effect-providing pigment with the powder-based binder is further defined as impact bonding the color effect-providing pigment to the powder-based binder.

43. A method as set forth in claim 33 wherein the step of (B) applying the powder-based coating composition to the substrate to produce the second color effect is further defined as spray applying the powder-based coating composition onto the substrate.

44. A method as set forth in claim 33 further comprising the step of curing the film layer of the powder-based coating composition such that the film layer of the powder-based coating composition is cured to produce the second color effect.

45. A method as set forth in claim 33 wherein the pigment substrate of the color effect-providing pigment is selected from the group consisting of metallic pigment substrates, non-metallic pigment substrates, and combinations thereof.

TRANSLATION